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MEMORANDUM

CONCERNING

SMALL MONEY:

WITH

ILLUSTRATIONS AND DESCRIPTIONS

OF

EXISTING NICKEL ALLOY COINS.

BY

JOSEPH WHARTON.

LIBRARY OF
THE REFORM CLUB
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52 William St., New York.

MEMORANDUM

CONCERNING

SMALL MONEY.

BY JOSEPH WHARTON.

General Remarks upon Small Coinage.

MONEY, in its strict original meaning, is bits of metal, prepared by weighing and stamping for use as a circulating medium for payments, and possessing intrinsic value nearly or quite equal to its nominal value.

Although promissory notes, bills of exchange, bank credits, open accounts, and currency redeemable on demand, have long been made use of for dispensing with coined money, they are, of course, only applicable to comparatively large transactions.

The innumerable petty transactions in which a small service is to be requited or a small purchase settled, cannot readily be effected without the actual transfer of some object or token, the giving and taking of which end the matter forever; for not only is it troublesome to record and to postpone receipt of small claims, but those who have such small dealings, being mostly of the poorer classes, and of somewhat uncertain abode and solvency, would be obliged to pay by higher prices for the risk involved, as well as for the trouble and delay of postponement.

A sufficient and suitable coinage of low denominations is the proper preventive of those evils, as well as the indispensable means of adjusting to a point the numerous large payments which are effected by coined or paper money, and it is an important duty of Government to provide an abundant quantity of such coinage.

The objects or counters composing that small coinage may, however, have the full intrinsic value of their denomination, or they may be a token currency, redeemable on demand. A third alternative: that they may be of very deficient intrinsic worth, and yet not redeemable, seems unlikely to find favor henceforth.

Which should they be?

On the one side of this question is the consideration that every holder of such a counter would possess the intrinsic value of the wares or services which he gave for it, and could therefore with certainty obtain for it at any time a similar amount of wares or services.

On the other side are the considerations, that

1. Whenever the material of intrinsically valuable coins becomes, by commercial or financial fluctuations, of more worth in money of account than the denomination of the coins, they are exported or melted, which in the case of small coins, subjects the community to insufferable inconvenience. They are also liable at times to withdrawal from circulation by being hoarded.

2. A great loss is incurred by interest upon the amount of the intrinsically valuable material required.

3. The loss from abrasion of so great a multitude of small silver pieces, and from mislaying them, is very great, amounting probably to over one per cent. per annum.

Here are surely sufficient reasons why full intrinsic value is not preferable, provided the one desideratum of

absolute acceptability as currency at all times can be otherwise attained. This quality may, however, be perfectly attained by making the counters redeemable by Government—that is, by making them Government promises to pay—and by making them legal tender for a limited amount.

A money token which is quite certain to be redeemed by exchange of intrinsic value for it when required, can perform within its own territory every function of intrinsically valuable money, and the small money of a country is not intended ever to be used to settle international balances; it should, in fact, be of such a nature as to preclude all temptation to send it out of the country, to hoard it, or to convert it to any other use than currency.

As the total amount of small money required is quite insignificant, compared to the wealth of the country, and as the public will inevitably and always retain in circulation a tolerably uniform and increasing amount thereof, it cannot be urged that a small coinage, consisting virtually of Government promises to pay, would be a burdensome national debt.

In fact, nearly all the difference between the cost price and the denomination or issue value of so many token coins as the convenience of the nation requires, may safely be regarded as a real profit, and it will merely be necessary for the Government to hold itself prepared to meet occasional temporary and partial refluxes of petty coins at those times and places where they are in excess of immediate wants.

Token coins should be made legal tender for all sums below some moderate amount, such as five francs or one dollar, and be redeemable by Government at certain designated offices, in legal money of gold, silver, or paper,

when presented in sums of not less than some convenient amount, such as one hundred francs, or twenty dollars. They should be obtainable at these offices, as well as at the mint, in exchange for legal money; the several denominations should, when practicable, all be made of the same material; lastly, the several denominations should be marked by a general similarity of design, and by dissimilarity from the devices and appearance of the more valuable coins. They should be of the finest workmanship.*

Proper Denominations and Quantity of Small Coins.

It is obvious that experience alone can determine with any exactitude the quantity of small money which any nation should possess. It is also clear that in the case of a redeemable system of small money, the public, who, by having the right of conversion are able to limit the total issue, will take care that no excess shall exist, while the Government, which makes a large profit upon the coinage, will take care that there shall be no deficiency.

The experience of other nations may, however, aid us to form an estimate of the quantity required.

The first point to determine is the range of denominations to be embraced in the system. Probably a safe rule would be, that all coins below the denomination of about one-half franc, or ten cents, should be token coins.

Some countries, however, for instance Brazil, prefer to make their ten cent coin a token, while others, though using some redeemable token coins, make one or more smaller ones of copper or of bronze. For our present purpose we may assume that at least two coins would be needed of such token material as nickel alloy, viz.: one

* Chevallier says: "Il faudrait un billon beau comme des médailles pour que le péril de la contrefaçon fut bien écarté."

of about 5 cents, or about 20 French centimes, and another of half that value.

The United States has, in 1876, about $11,000,000 of tokens of the denominations of 5 cts., 3 cts., 2 cts. and 1 cent, for a population estimated at 44,000,000. About 25 cents per capita.

France, having a population, including Algeria, of about 40,000,000, proposed to limit the issue of bronze coins, the largest of which is 10 centimes, or 2 cents, to 40,000,000 francs, or $8,000,000, but found that quantity insufficient.* About 20 cents per capita.

Belgium, whose population was, in 1856, 4,530,000, had, in 1860, a copper coinage of rather more than $1,000,000 in pieces of a cent and under, and on adopting, in 1860, a system of nickel alloy coinage (25 parts nickel, 75 parts copper), proposed to issue

Pieces of 20 centimes	(4 cents),	4,600,000 francs, say	. .	$900,000
" 10 "	(2 cents),	2,600,000 "	. .	500,000
" 5 "	(1 cent),	2,000,000 "	. .	400,000

I have been informed, however, that nearly $4,000,000 were found to be needed and were issued. About 80 cents per capita.

Switzerland, whose population was, in 1860, 2,534,000, had issued German-silver coins up to that time as follows:—

Pieces of 20 centimes,	2,312,000 francs, say	. . .	$460,000
" 10 "	1,331,600 "	. . .	260,000
" 5 "	1,001,100 "	. . .	200,000
			$920,000

* The old copper and bell-metal coinage of France, preceding the bronze, was estimated at 40 to 45 million francs.

The proportion of copper coins to gold and silver coins in France, about 20 years ago, was as 2 to 100 in value. In Russia, from 1762 to 1811, that proportion was 65 to 100.

But that quantity was still insufficient. About 30 cents per capita.

The German Empire, which, by the mint law of 1873, ordained a nickel-copper coin of 10 pfennigs, or 2½ cents, and another of 5 pfennigs, or 1¼ cents, expected to make 450 million of the former and 600 million of the latter; a total value of over $18,000,000, spreading the manufacture over six years. About 45 cents per capita.*

From such data as these, it has been reckoned in Europe that the maximum of petty coins, not exceeding the denomination of 10 centimes (say 2 cents), which should be issued, is about 2 francs (say 40 cents) for each individual composing the nation.

It is certain that the various conditions of compactness of the population, their wealth, the nature of their industries and their habits, must vary greatly the ratio of petty coins to the number of inhabitants in the several countries of the world, and that each country must decide at last by its own experience what is required for its own convenience in this purely domestic matter, but the quantity needed of such coins as the two proposed on p. 5, would seem likely to be at least 40 cents per capita.

Of course, if a suitable system of small coins should be established, convertible at the pleasure of the holder into lawful money of the larger denominations, the manufacture of the coins would continue so long as the public demanded them; it would be checked or would cease when they were no longer called for, and would only be resumed at a moderate rate to replace the pieces lost or destroyed, and to satisfy the increase of population.

* I have not been able to learn how much copper coin exists in England. The amount issued in 10 years preceding 1861, was about $2,400,000 in pieces of 1 penny and under. In that year the coinage of bronze began, and has since continued at an irregular rate, the largest annual amount apparently being about $1,350,000 in 1861.

Materials for Small Coins.

A perfect material for small coins should be cheap, handsome, not readily oxidable or alterable by any chemical agency which coins in ordinary use might be exposed to; capable of being readily melted, rolled, punched, stamped, &c., by adequate means; taking a perfect impression of the die, durable in wear, and hard to counterfeit.

Of the many metals and alloys known to mankind, very few have qualities to fit them for this use.

Those which have been actually adopted in recent times are as follows, beginning with the least valuable, viz: 1, pure copper; 2, bronze (*i. e.*, copper, tin and zinc); 3, German-silver (*i. e.*, copper, nickel and zinc); 4, a sort of German-silver, containing a little silver in addition to the other ingredients; 5, copper and nickel alloys of several proportions; 6, copper and silver alloy, or low standard silver; 7, silver of ordinary coin standard. Besides these well-known materials, I may name, 8, aluminum, and 9, aluminum bronze.

Let us review these candidates.

No. 8. Aluminum is a handsome white metal, of remarkable lightness (being about one-third the weight of copper), hard and moderately ductile; coins made of it would be attractive from their beauty and lightness. This metal dissolves with extreme facility in hydrochloric acid, and is even corroded by ordinary salt or pickle. I have seen a dinner fork of aluminum, half eaten away by standing in a jar of pickles containing salt. Its qualities have not yet procured for it any considerable use in the arts, though its price has been greatly reduced.

No. 9. Aluminum bronze is a compound of aluminum and copper, in varying proportions. I have specimens in

ingot, sheet and wire, of the three qualities; 5 aluminum, 95 copper; 10 aluminum, 90 copper; 15 aluminum 85 copper. As the alloy containing 10 parts of the former with 90 parts of the latter metal has been most thoroughly tested, and found the most available for use in the arts and for coins, I will speak of it only, and will say in a few words that a careful examination of its qualities by the United States Mint, proved it to be too rigid for coin material. It was possible to roll it into strips, cut it into planchets, and stamp it into coins, but the difficulties were so great as to make it appear practically unfit for coinage. This remark applies also to No. 8, or pure aluminum.*

It is worthy of remark also, that there is no such quantity of aluminum made anywhere as would be required to supply a national coinage. The best material, Cryolite, is abundant in Greenland, and a considerable quantity of aluminum has been made from it at Newcastle, England. Since all clay contains a large proportion of aluminum, it is by no means impossible that methods may hereafter be found to extract it at so very low a price

* I am permitted to insert the following notes on a specimen bar of aluminum bronze sent to the U. S. Mint by a committee of the National Academy of Sciences of the United States, May, 1864:—

"Mr. Eckfeldt finds the proportion of aluminum by assay to be 9.8 per cent.; evidently meant for 10 per cent.

The specific gravity is 7.63.

The weight of a planchet of same bulk as the legal bronze cent planchet is 40 grains; the bronze weighing 48 grains.

To draw a wire of the aluminum bronze from one-tenth inch diameter down to one-twentieth, required 21 draughts and 4 annealings; to reduce a copper wire from one-tenth to one-twentieth required 7 draughts and no annealing after the initial one. Carried in the hand for a few hours, the aluminum bronze becomes quite tarnished. Exposed to a low heat (under cherry red), the al. bronze and the bronze used for coin are about equally oxidized.

The color of aluminum bronze is a handsome orange yellow."

as to make it too common for coin material. In any case, its time has not yet come.

Of the materials hitherto used for low coinage—

No. 1, or pure copper, has, until recently, been the most generally used in almost all countries. It is cheap and easy to work, but is too easily oxidable, rather too soft, and emits a most disagreeable odor when handled. If coins made of it possess intrinsic value nearly equal to the nominal, they are too bulky for most of the denominations needed; if tokens should be made of it with denominations far above their intrinsic value, they would be counterfeited *ad infinitum*, since copper can be had anywhere, and offers no difficulty in working.

No. 3. German-silver has some good qualities, and has been considerably used for coins in Germany.* It is cheap enough, easily worked, and when new is sightly enough. It is, however, rather too soft to wear well, or to offer sufficient difficulty to counterfeiters; it acquires by use a brassy look, unless richer in nickel than the specimens I have seen, and is liable to the objection common to all alloys containing zinc, that the great volatility of that metal at the melting point of copper, tends to cause a variable quantity of it to fly off as vapor, leaving the alloy of uncertain and varying composition. The convenience of assay is greatly in favor of binary compositions for coin metal.

No. 4. German-silver containing silver was adopted in Switzerland, because it was thought necessary to add a little silver to satisfy popular prejudice. The example has not been followed in other countries, for the silver thus added is simply wasted.

No. 6. Silver of low standard, viz.: $\frac{3}{4}$ silver, $\frac{1}{4}$ copper,

* Venezuela is now introducing German-silver coins.

was at first employed in the United States 3 cent piece, but after two years' experience it was abandoned for the usual standard silver. The low standard 3 cent pieces were marked by a yellowish and paltry appearance, and many instances of similar low standard silver pieces looking well when new, and paltry afterwards, will be found among European coins of a past age. It can hardly be doubted that if intrinsic value is to be given, it can best be done with standard silver. If, on the contrary, a token system is preferred, tokens can be made both cheaper and better of other material than low standard silver.

No. 7. Standard silver is of course too valuable to be used for tokens, and when coins are made of it they are expected to have intrinsic value nearly equal to their nominal value. As the chief arguments for a token system have already been given, I will only say here, that the loss of precious metal by wear and mislaying of coins, is an absolute loss of so much to the world, and that these causes operate most upon the small coins.* No objection can be urged against silver on the score of fitness for working, of beauty, etc., but economy demands a cheaper and more durable material; and the public convenience demands one which will never be removed from circulation by hoarding, melting, or export.

No. 2. Bronze. The copper, tin, and lead alloy, coined by the Romans five hundred years before our era; the copper, tin, and zinc of Roman coins several centuries later; the various alloys of divers proportions of copper

* M. Custer estimates that in Switzerland a new coinage of about 2½ per cent. per annum is required to keep the total of small coinage constant.

When the French 15 cent and 30 cent pieces, coined in 1791 and 1792, were demonetized about half a century later, only 16,000,000 were returned out of 25,000,000 issued.

and tin used in the arts for statuary, cannon, bells, etc., are all entitled to the name of bronze, but none of them has been found so suitable for coinage as that now used in France, in England, and for the 1 cent coin in the United States, viz.: 95 copper, 4 tin, 1 zinc.

As great stress has been laid upon the example of France, it seems proper to review the history of bronze coinage in that country. We find, then, that bronze coins were introduced in France, not as an improvement upon copper, but as a make-shift, in the time of the first Republic; for France, producing no copper and being commercially isolated from the rest of the world, was unable to continue the issue of petty coins, except by using as material the bells of churches, convents, etc. When, during the Consulate, France was again able to procure copper, this involuntary coinage of bronze was abandoned, and the low coinage was made of pure copper only, until the reign of the late Emperor, who found France flooded with a great variety of copper coins, so diverse in size and appearance, and many of them so shabby, that a change which would replace them all by a new and uniform system seemed necessary, while yet the withdrawal of so great a mass of stuff of little value would entail a very serious sacrifice unless the cheapest presentable substitute were employed. This necessity, however, does not exist everywhere.

It is clear that the objections which apply to copper apply almost equally to bronze. Coins made of it, though clean and of a golden yellow when new, soon acquire by use a disagreeable odor and a valueless appearance. Bronze is moreover so cheap, so easily made, and so easily worked that it offers no difficulty to counterfeiters; if used for any coins but the lowest, coins identical with the genuine in appearance and composition, would

therefore be multiplied with very little chance of detection.

No. 4. Copper and nickel alloys have been experimented with in proportions varying from 10 nickel, 90 copper, to 50 nickel, 50 copper. The only ones yet used for coins are: 1st. 12 nickel, 88 copper (adopted in the United States for cents in 1857, and displaced for bronze in 1864, because the latter was cheaper and nickel was hard to get*); and 2d. 25 parts nickel, 75 copper, now used in the United States 5 cent and 3 cent coins, in the 10 pfennig and 5 pfennig pieces of Germany, in the entire petty coin system of Belgium, and in the coins of Brazil, Chili, Jamaica, and some other countries. An alloy, still richer in nickel, would be practicable with pure metals and due care in working; indeed I have specimen coins of *pure nickel* made of my nickel. The alloy of ¼ nickel ¾ copper is, however, good enough.

The alloy of 12 to 88 is far superior to copper or to bronze, but it resembles them too nearly. The alloy of 25 nickel to 75 copper certainly possesses, in a marked and hitherto unequalled degree, all the properties desirable in a material for token coins. It is cheap enough, handsome, unalterable under all ordinary conditions, durable in wear, and extremely hard to counterfeit. Its hardness is to that of copper as 3 to 2. It is hard to melt, hard to work and stamp; it yields only to the very best appliances, but yields to them perfectly, making very agreeable, cleanly, and beautiful coins, with sharp impressions of the dies. The skill, the requisite apparatus, and even the material,† are practically beyond the

* Used also by Peru for 2 cent and 1 cent pieces, and by Costa Rica.

† Nickel is a rather rare metal, occurring mostly in ores of two per cent. or less, which ores are very hard to reduce. It is made extensively in hardly half a dozen places in the world, the first in magnitude and perfection of those establishments being my own in the United States, which has of course supplied most of the nickel used for the United States coins; also a considerable part of that used for the new coinage of Germany, and that used for Peru and Venezuela.

reach of counterfeiters, and no imitation of coins made of it has ever had any considerable success in any country.

Profit of Introducing Nickel Alloy Coins.

As every civilized nation at the present day is supplied, more or less perfectly, with coins, the practical questions for most of them in regard to the introduction of nickel alloy coins are: 1st. Do we need any new denominations of small coins? and, if the answer be negative, then 2d. Can our system be improved by the substitution of nickel alloy coins for any of those now in use?

My own conviction being fixed that the smallest possible number of varieties of coins should be used, I believe that to the first of these queries a negative answer must, in most cases, be given. To the second, I think many nations must answer to the effect (1) that either one or more coins of base silver might properly be withdrawn —a larger denomination giving place to standard silver, and a smaller one to nickel alloy; or (2) that a small standard silver coin might be replaced to great profit by nickel alloy of larger and more convenient size; or (3) that a large and dirty coin of copper or bronze might be suppressed in favor of a small and cleanly one of nickel alloy.

It is to be remembered that, as coining is a continuous process in every country, the commencement of a better system at any time will lead, after a few years, very easily and almost imperceptibly to the complete substitution of that better system. The old coins will, when paid into

any government office—the railroads might by law be included—be sent to the mint to be exchanged for the new money, the material of the old coins being in most cases used in the new. Small standard silver coins will be melted and recoined into larger pieces. Base silver coins, such as half silver and half copper, will be remelted with enough silver to produce standard silver coins. Copper coins will be melted with the due proportion of nickel to form the standard nickel alloy.

Only coins of bronze and German-silver could not be utilized in this manner. As to all the others named there is no technical or practical difficulty whatever in the conversions stated, unless the copper coins should happen to have been made of metal so impure as to be unfit for yielding, with nickel, a readily workable alloy, in which rather improbable case the old copper would have to be sold and new copper of better quality purchased. Even in that case, or in the case of replacing bronze, the question resolves itself, as in other cases, into one of cost. How much would it cost to make the desirable change?

As preliminary to that investigation, I will examine the probable profit to Government of an entirely new issue of nickel alloy coins. That profit would, of course, be realized upon all coins made beyond those needed merely for replacement of the old, and as the populace would require many more of the cleanly and beautiful new coins than of the disagreeable or inconvenient old ones, this would prove to be a larger proportion of the whole first issue than might be supposed.

A normal system of coins for any country may be assumed to consist of: 1. Three pieces of standard gold of standard intrinsic value to serve as unlimited legal tender; 2. Three pieces of standard silver of equal proportionate value, being about ten per cent. less than the

nominal value, to serve as subsidiary money, and to be legal tender for any sum not exceeding some suitable limit, such as ten dollars or their equivalent; 3. Three token pieces of base metal, having intrinsic value about one-third the nominal value, to be legal tender for about one-tenth or one-twentieth as large a sum as the silver money—say, for one dollar—and to be redeemable, under proper regulations, by the Government. All these token coins should be of nickel alloy, though the lower one or two may be made of copper or bronze.

I will first assume that all the token coins, viz., of five cents, three or two cents, and one cent, or their equivalents, are of the standard alloy one quarter nickel and three-quarters copper, and that the weights are about one gram for each one cent. In practice a coin of one gram is too small, and the one cent coin should weigh one and a half grams, as my estimate will assume it to be.

For each million of population the maximum of coins needed, of all denominations, from five cents to one cent, would probably be about as follows:—

Coins of 5 cents,	8,000,000	weighing 5 grams each,				40,000	kilos.	$400,000
" 2 "	6,000,000	"	3	"	"	18,000	"	120,000
" 1 "	6,000,000	"	1½	"	"	9,000	"	60,000
Total pieces,	20,000,000			Weight kilos.,		67,000	Issue,	$580,000

To those 67,000 kilos. must be added loss of weight in manufacture, which may be assumed as about seven per cent., showing the quantity of metal required to be 72,000 kilos., of which one-fourth, or 18,000 kilos., is nickel, and three-fourths, or 54,000 kilos., is copper.

Taking as our guide a price somewhat below the average price paid for the nickel used in the coins of the German government, we assume the price of these 18,000 kilos. at $5.50 per kilo. (equal to about ten shillings per lb. English), and the copper we may suppose likely to

cost fifty cents per kilo. (equal to about eleven pence per lb. English). The cost of manufacture, exclusive of waste of material, will naturally vary in different places, but will probably never be more than one-half the cost of the materials. Taking it as one-half, the account stands thus:—

Issue value of twenty million pieces, 67,000 kilos.,		$580,000
Cost of nickel—18,000 kilos., at $5.50, $99,000		
Cost of copper—54,000 kilos., at 50 cts., 27,000		
	$126,000	
Add one-half for cost of manufacture,	63,000	
		189,000
Total net profit (67½ per cent. of issue value)		$391,000

If any government could count upon supplying its entire population of five millions or fifty millions with small coins after this schedule, a clear profit of two million dollars or of twenty million dollars could be reckoned upon with certainty; for, as has already been remarked on page 3, the entire difference between the issue value and the nominal value of those small coins which the country requires, really enures to the benefit of the government, although the latter may have engaged to redeem all when presented.

In practice, however, the problem is not so simple, being complicated by the necessity of accommodating the new system to the old, and, perhaps, of recalling one or more of the old coins which are to be superseded by the new.

Russia Considered in Detail.

In order to illustrate this class of cases, let us consider that of Russia, a country already possessing a superabundant variety of small coins, viz., subsidiary silver coins, 500-1000ths fine, of 20, 15, 10, and 5 copecks; and copper coins of 5, 3, 2, 1, ½, and ¼ copecks.

It appears obvious that a coin so small as a quarter copeck can have little or no use, and may be disregarded; and, judging by the experience of the United States with the now obsolete half cent, the utility of a half copeck (worth about one-third less than the half cent) seems doubtful. Considering, then, only the coins of five, three, two, and one copecks, the first impression is that to have two distinct coins—one of silver and one of copper—to represent the same amount (five copecks) is surely inexpedient, as introducing complication and possible confusion where all should be simple and certain. The next impression is that the five copeck silver coin, weighing 9-10ths of a gram, is quite too small for convenience. A coin so small as this is cannot be so readily and accurately made as a larger one, is too easily lost, and too soon becomes indistinct from abrasion. Again, the five copeck copper piece, weighing nearly sixteen grams, is quite too heavy for convenience. Both of those coins might, with great propriety, be replaced by a five copeck coin of nickel alloy of a suitable weight, small enough, cleanly enough, and beautiful enough to please the upper classes, while commending itself to the lower classes not only by these qualities, but by its apparent superior value to the copper coin.

A three copeck coin might also be made of nickel alloy to replace the present three copeck copper weighing about nine and one-third grams. These two nickel alloy coins would be distinguished from any silver coins, not so much by the difference of tint as by marked difference of design, and by having smooth edges.

The copper coins of two copecks, one copeck, and half copeck would be left, for the present, undisturbed, though the last, and, perhaps, also the first, might apparently be dropped without disadvantage.

The old copper coins of five and three copecks, weighing (say) three and one-third grams per copeck, are composed of copper costing about twelve rubles per pood, but representing an issue value of about forty rubles per pood. Taking the ruble as 74 1-10th cents, and the pood of 40 Russian lbs. as 36.11 English lbs., the cost of copper would be 24.63 cents per English lb.

The cost of material in one ruble or 100 copecks of copper coins, viz., 333 grams or $\frac{73}{1000}$ lb., is, therefore, 18.07 cents = 54.21 cents per kilo.

Retaining this price for copper, and taking for nickel the price above given—$5.50 per kilogram, and assuming for the nickel-copper coins a lighter weight than that previously suggested, viz., one-half gram per copeck (the five copeck to weigh two and a half grams and the three copeck one and a half grams) the cost of material would be, for—

12½ grams nickel, at $5.50 per kilo . . .	6.875 cts.	
37½ " copper, at 54 cents per kilo . .	2.025 cts.	
		or 8.90 cts.
If to this cost of material for the new coins, we add, what for Russia would be the excessive cost for manufacture including waste, of one-half the cost of material, viz.: .		4.45 cts.
We have as the total cost of 100 copecks of new coins .		13.35 cts.
And, deducting this from the value allowed for the old copper of the present copper coins, per 100 copecks, viz.: .		18.07 cts.
We find a net profit in conversion, per 100 copecks of .		4.72 cts.

NOTE.—The specimen coins exhibited at the U. S. Centennial Exhibition by the Russian government, weighed at the United States Mint in Philadelphia as follows (Mr. Eckfeldt):—

Silver			Copper		
20 copecks,	3.597 grams.		5 copecks,	15.813 grams.	
15 "	2.705 "		3 "	9.319 "	
10 "	1.791 "		2 "	6.542 "	
5 "	.907 "		1 "	3.290 "	
			½ "	1.562 "	
			¼ "	.764 "	

If, however, only a single nickel alloy coin should be introduced, viz, a five copeck coin, it might be made to weigh but two grams, or forty grams per 100 copecks, and the profit of conversion, per 100 copecks, would then be 7.39 cents, U. S. currency.

Of course, the profit upon a new issue of coins of these weights and denominations would be, for five copecks of two and a half grams and three copecks of one and a half grams, the difference between 74.10 and 13.35, *i. e.*, 60.75 cents per 100 copecks, and for five copeck pieces of two grams would be 63.42 cents per 100 copecks.

Turning now to the silver five copeck pieces, containing $\frac{4.5}{1000}$ gram of silver and $\frac{4.5}{000}$ gram of copper, it appears scarcely necessary to reckon the gain from their conversion, because: 1. Those coins could readily be recoined into ten copeck pieces without loss, thus leaving the whole difference between issue value and cost of the replacing nickel alloy coins as gain; and, 2, the five copeck silver coins are few. To complete the illustration, however, we will assume that the copper in the silver five copeck pieces is valueless, and that those coins are to be utilized by adding enough pure silver to melt them into standard bars for the higher silver coinage.

We have then as intrinsic value of 100 copecks of five copeck silver coins	37.05 cts.
And the cost, as above, of 100 copecks nickel alloy coins,	13.35 cts.
Showing net profit in conversion of 100 copecks . .	23.70 cts.

If the coins should be made to weigh one gram per copeck, the profit upon new issues would be 47.40 cents per ruble, and that upon conversion of silver pieces would exceed the loss upon conversion of copper.

Since for each country similar calculations could readily be made, no further illustrations need be given.

Probable Extension of Nickel Alloy Coinage.

The countries now using coins composed in part of nickel are: 1, the United States of America; 2, Belgium; 3, Switzerland; 4, the British island, Jamaica; 5, the Empire of Brazil; 6, the German Empire; 7, Peru; 8, Chili; 9, Venezuela; 10, Honduras; 11, Costa Rica, and perhaps others of which I am not informed. Below will be found wood-cuts of most of these coins.

It will be observed that populations aggregating considerably over one hundred millions, and including some of the most enlightened nations of the earth, have already availed themselves of the advantages offered by coins of nickel alloy, but it cannot be doubted that the system is destined to a wide extension. Upon this continent; Canada, Mexico and several South American republics—in Europe; England, France, Spain, Portugal, Italy, Austria, Russia, the Scandinavian Kingdoms, Holland, Turkey, Greece and Roumania—in Asia; India, China, Japan, Persia, Siam; also Egypt, Australia, New Zealand and other countries have yet to embrace it.

Although the advantages of making small coins of nickel alloy may be quite apparent, a prudent government would doubtless wish to be well satisfied, before adopting the system, that an adequate supply of nickel can be procured. The entire quantity of this metal annually produced has hitherto been so moderate, and has been so entirely required for use in the arts, that some solicitude might naturally be felt upon this point, for the extraction and refinement of nickel are so much more difficult and tedious than other metallurgical processes, that a sudden large increase in the demand might temporarily so far outrun the resources as to produce extravagant prices and a sort of famine.

This result was greatly feared in 1872 and 1873 by the chief consumers of nickel when the German government was considering the propriety of establishing a nickel alloy coinage. They thought it necessary to address remonstrances to that government, stating that the adoption of that project would probably drive the price of nickel so high as to cause the ruin of their business, and would at last end in the failure of the project for want of the needful nickel. It cannot be said that this solicitude was altogether groundless, seeing that Germany intended to consume in five or six years for her coinage as much nickel as the entire annual production of the world—say about 500 tons; but the chief producers, myself among them, counteracted those representations by assurances of sufficient supplies; and, in fact, no inconvenience has arisen from 1873, when the coinage was commenced, to the present moment.

After that experience it may safely be assumed that no trouble is likely to be caused by any demand for coinage, unless possibly by two or more large nations undertaking simultaneously to establish nickel coinage, and raising the price unduly by bidding against each other; but this could of course be readily avoided by contracting beforehand with nickel manufacturers, or even by consulting with them. For many nations the easiest and best course would be simply to contract for the delivery of the entire quantity of coins desired, or of the planchets ready to be struck in the national mint.

The recent discoveries of nickel ores in New Caledonia give a fresh assurance that for some years at least sufficient supplies of nickel may be relied upon.

Before proceeding to describe particular coins, it seems expedient to remark that in choosing devices for nickel-copper coins, those in high relief, and particularly

those having high relief at the same spot upon both sides of the coin, are objectionable; for, this alloy being harder than other coin material, the difficulty of bringing up such devices is proportionately greater. Of course the quality of the metals employed influences greatly the ease of manufacturing nickel-alloy coins, and I may be allowed here to remark that my nickel, being made with the greatest care exclusively from the excellent and abundant ore of my own mine, appears to offer advantages for coin making comparable to those enjoyed by Lake Superior copper for cartridge making.

Devices unnecessarily complicated, or in any way producing a generally rough surface, always to be avoided for coinage, are for coins of low value especially disadvantageous, because the greater circulation of those coins among the poorer classes gives the greater opportunity for dirt to lodge in all such crevices or roughnesses. When large quantities of the 12 per cent. nickel cents (amounting sometimes to 20 tons), taken by the United States government in exchange for the new 25 per cent. nickel coins, were kept in close vaults under the Mint until wanted for melting, the stench of putrefying matter was distinctly perceptible joined to that of copper.

Although in coins containing 25 per cent. of nickel no taint of copper is perceptible, cleanliness, no less than beauty, requires that their surfaces should be generally smooth. When so made, an experienced touch clearly perceives in them a characteristic slipperiness different from the feel of silver coins.

The German government having temporarily discontinued the manufacture of nickel alloy coins, in order that the several mints may be free to engage in the coinage of silver, a fall in the price of nickel has resulted, and the reduced price thus established is likely to last until the nickel manufacturers have adapted their production to the decreased demand, or until other large coinage operations are undertaken. The present time is, therefore, remarkably favorable for making contracts either for the purchase of nickel, or for the manufacture of planchets or coins.

Description of Existing Nickel Alloy Coins.

The United States of America.

Fig. 1.

The earliest of nickel-copper coins is shown by this cut, which represents one of a series of experimental coins made from alloys prepared by Prof. James C. Booth, of the U. S. Mint. These alloys ranged from 5 nickel 95 copper, to 30 nickel 70 copper. No coins of this device were put into circulation.

Fig. 2.

Fig. 3.

Those experiments resulted in the adoption, by law passed February 21, 1857, of the alloy 12 nickel, 88 cop-

per as material for a one cent coin. This coin weighs 72 grains, and was at first made bearing the devices shown by Fig. 2, which devices were afterwards changed for those shown by Fig. 3. April 22, 1864, a law was passed discontinuing the manufacture of this coin, and ordaining bronze coins of two cents and one cent. By act of March 3, 1871, this coin was ordered to be received at the Mint in exchange for the nickel three cent and five cent coins next described, and for the bronze coins above named.

Total quantity issued, excluding fractions . . .	$2,007,720
Redeemed to June 30, 1876	571,840
Remaining in circulation June 30, 1876	$1,435,880

By act of Congress dated March 3, 1865, a three cent coin was ordained, to be made of 25 parts nickel 75 parts copper, and to weigh 30 grains.

Fig. 4.

This beautiful coin has the important fault that its diameter is exactly that of the present ten cent silver coin; a fault which would be perfectly remedied by increasing its weight to 3 grams in correspondence with the five cent piece of 5 grams, or $77\frac{16}{100}$ grains.

Total amount issued to June 30, 1876 .	$855,090	
Reissued " " " . .	109,142	
		$964.232
Redeemed " " " . . .		109,923
Remaining in circulation June 30, 1876		$854,309

By act dated May 16, 1866, a five cent coin was ordained, to be composed of 25 parts nickel 75 parts copper; weight $77\frac{16}{100}$ grains, or 5 grams; diameter $\frac{16}{25}$ of an inch

It bore at first the devices shown by Fig. 5, and afterwards those shown by Fig. 6.

Fig. 5.

Fig. 6.

The diameter of this coin being too small for its weight, it has an awkward and lumpy appearance, and is entirely devoid of resonance. The design of its face strongly suggests the old fashioned pictures of a tombstone surmounted by a cross and overhung by weeping willows, which suggestion is corroborated by the religious motto. It is a curiously ugly device.

This coin should be replaced by one of the same weight and composition, but of larger diameter and similar in device to the three cent coin Fig. 4.

Total amount issued to June 30, 1876 .	$5,747,840	
Reissued " " " .	968,289	
		6,716,129
Redeemed " " "		973,712
Remaining in circulation " "		$5,742,417

The gross incongruity of the five cent and three cent coins, and the practical inconvenience at the Mint of working two different alloys for base coins, led in 1868 and 1869 to a series of experiments for the production of

a harmonious and complete system of nickel alloy coins. A ten cent coin of 10 grams having been condemned on account of its too great weight and the probable eventual return to a silver dime, and a one cent coin of 1 gram having been found inconveniently small, the series represented by figures 7, 8, and 9, was fixed upon by the Director of the Mint, and a bill ordaining them was introduced into Congress. For reasons which are not apparent, it failed to become a law, and this desirable reform, now made easier by the abolition in 1872 of the bronze two cent coin, still waits. The proposed weights are $1\frac{1}{2}$ grams, 3 grams and 5 grams.

Fig. 7.

Fig. 8.

Fig. 9.

This sketch of the history of nickel coinage in the United States shows the importance of acting upon a well considered plan, so that what is done may be well done and require no change.

Belgium.

The Belgian nickel coin law adopted by the Senate June 28, 1860, ordains that small coins shall be made of a nickel-copper alloy containing at least 25 per cent of nickel; that they shall be of five, ten, and twenty centimes, weighing respectively 2, 4, and 6 grams; that no person shall be obliged to receive more than five francs of them in payment, though the government may receive them for taxes in larger sums; that the government will receive them and give them at certain places and under certain regulations in exchange for larger money.

Fig. 10.

Fig. 11.

Fig. 12.

These excellent coins are shown by figures 10, 11, and 12. The law is simple, distinct, and complete. No fault

can be found with the coins except that the design of the twenty centime piece differs from that of the others, and that the cross-hatching upon the two smaller pieces is remarkably well adapted for holding dirt.

Switzerland.

By the Federal law of May 7, 1850, concerning the Confederate Mint system, small coins are ordained of twenty, ten, and five rappen or centimes, weighing respectively $3\frac{1}{4}$, $2\frac{1}{2}$, and $1\frac{2}{3}$ grams, and containing respectively $\frac{15}{1000}$, $\frac{10}{1000}$, and $\frac{5}{1000}$ gram of fine silver. The alloy, composing almost the entire weight, of these coins is ordained to be of copper, zinc, and nickel, in proportions not stated in the law. No one is obliged to take in payment more than twenty francs of these coins, which are represented by figures 13, 14, and 15.

Fig. 13.

Fig. 14.

Fig. 15.

These coins are convenient in size and are agreeable and harmonious in device, though the foliage differs in the different denominations. They are of a yellowish tint, quite inferior to the pleasing white of good nickel-copper alloy, and the silver they contain is of no use whatever. An experimental two cent coin was made in 1836 in the United States, composed of copper containing 2 cents' worth of silver, but the project being found inexpedient, it was abandoned.

Jamaica.

Figures 16 and 17 represent the penny and half penny of Jamaica; very handsome and suitable coins. Having been unable to procure a copy of the law under which they are issued, I cannot state their composition authoritatively, but have read in a newspaper that it is 25 nickel 75 copper. I find the weights to be 148.75 grains, and 87.18 grains; probable normal weights 150 grains and $87\frac{1}{2}$ grains.

Fig. 16.

Fig. 17.

Brazil.

An Imperial decree dated September 3, 1870, ordained among other things "the coinage of small coin of an alloy of 25 parts of nickel and 75 of copper, and of the value of 200, 100, and 50 réis, the first weighing 15, the second 10, and the last 7 grams." These values are equal to 10.89 cents, 5.44 cents, and 2.72 cents of U. S. money.

The official exhibit of the Empire of Brazil published for distribution at the U. S. Centennial Exhibition in 1876, while making no statement of the amount of nickel coins issued, shows that the government derived a profit of over $564,000 from this issue in the four preceding years.

The 50 réis piece exists as yet only in the decree, none having hitherto been coined. The coin of 200 réis is remarkable as being the largest yet made of nickel alloy; it is in fact rather too large for convenient manufacture,

Fig. 18.

Fig. 19.

as the Imperial Mint has found in practice, though its difficulties have doubtless arisen in part, at least, from the inferior quality of the nickel employed.

The coins as issued are, however, very handsome and well made pieces, as will be seen from figures 18 and 19.

The German Empire.

The German Mint law of July, 1873, orders the coining of two coins composed of 25 parts nickel, 75 parts copper of the denominations of ten pfennig and five pfennig (equal to about 2½ and 1¼ cents U. S. currency), having diameters respectively of 21 and 18 millimetres, and weighing respectively $\frac{1}{12.5}$ and $\frac{1}{20.0}$ of a zoll-pfund.* These are very good specimens of what small coins should be, and no fault has been or is likely to be found with them. They are represented by figures 20 and 21.

Since the German Empire is composed of several nations or States, each having its own Mint establishment, the Chancellor of the Empire buys from private manufacturers planchets ready for coining, and transmits a suitable

Fig. 20.

Fig. 21.

* 11 pfund = 10 lbs.

quantity of these to each of the respective mints at Berlin, Würtemberg, Hamburg, etc., to be struck and issued.

Up to March 30, 1876, there had been actually struck in all those mints, 23,385,504 Reichsmarks of these nickel alloy coins, equal to $5,569,256.82 U. S. currency.

Peru.

Of Peru I can only say that in or before the year 1863 a law was passed ordaining the issue of coins of one centavo and two centavos (that is, one hundredth and two hundredths of the silver dollar), composed of 12 parts nickel and 88 parts copper. These coins, or at least the first issue of them, were made in the United States and from my nickel, but I have at present no means of ascertaining the amount now in circulation.

The coins are of neat design, as will be observed, but the alloy, following that then in use in this country, is inferior. I find these coins to weigh respectively 9.13 grams and 4.60 grams; probable normal weights 9 grams and 4½ grams. They are represented by figures 22 and 23.

Fig. 22.

Fig. 23.

Chili.

Chili has two handsome and well-made coins of the standard alloy, 25 parts nickel, 75 parts copper; one of one centavo, weighing 5 grams; and one of two centavos, weighing 7 grams. I have not seen the law creating them, nor do I know the quantity in circulation. Figures 24 and 25 represent these coins.

Fig. 24.

Fig. 25.

Venezuela.

The Republic of Venezuela ordered in August, 1876, the manufacture of ten million coins of one centavo, weighing 31 grains, and two million of two and a half centavos weighing 70 grains each; all to be composed of an alloy containing 20 per cent. nickel, 65 per cent copper, and 15 per cent zinc. These are now being rapidly manufactured, and are neat, handsome pieces, but are much softer than those made of ¼ nickel ¾ copper, and have a yellowish tint. They are shown by figures 26 and 27.

Fig. 26.

Fig. 27.

Honduras.

Of the four nickel alloy coins which Honduras is said to possess, viz: 1 real, $\frac{1}{2}$ real, $\frac{1}{4}$ real, and $\frac{1}{8}$ real, I have seen only the $\frac{1}{8}$ real and the $\frac{1}{2}$ real, represented by figures 28 and 29. They appear to be of the regular alloy, 25 nickel, 75 copper, but not having seen the law, and not wishing to destroy the specimens by analysis, I cannot certify to their composition.

Quantity in circulation unknown. Weights of the two specimen coins are, $\frac{1}{8}$ real $1\frac{1}{2}$ grams; $\frac{1}{2}$ real, my specimen shows 6.224 grams, normal weight doubtless 6 grams.

Fig. 28.

Fig. 29.

Costa Rica.

This State has a one centavo coin represented by figure 30. It appears to be composed of 12 parts nickel, 88 parts copper, and its weight is 58 grains.

Quantity in circulation unknown.

Fig. 30.

Miscellaneous.

In addition to the above actual coins of governments, may be shown three peculiar nickel alloy pieces. Figure 31 represents a coin struck from dies made in 1861 by a die sinker in Philadelphia, at the order of some one on behalf of the Southern Confederacy. About a score of impressions were struck in the alloy, 12 nickel, 88 copper, but the maker, becoming alarmed, buried the dies without attempting to deliver them, and they finally were broken. This coin is interesting as being the only one designed for the Southern Confederacy.

Fig. 31.

During the disturbed years 1848–49 in Europe, coins of all sorts became very scarce, and to remedy the intolerable dearth of small coins, the Berndorf Metalware factory, near Vienna in Austria, made for use in its own transactions the token shown by figure 32. It is composed of the standard alloy 25 nickel, 75 copper, weighs

6 grams, and represented $\frac{1}{6}$ gulden, or about $8\frac{1}{2}$ cents. Neighboring towns complained to the Austrian government that Berndorf only had money, but since the Berndorf proprietors had promised to withdraw them so soon as real coins could be had, the government did not interfere, and the tokens continued in use until the crisis had passed, when they were duly redeemed.

Fig. 32.

In the year 1837 Dr. Lewis Feuchtwanger, of New York, caused to be made a number of pieces composed of a nickel alloy, doubtless German-silver, though the exact composition is unknown to me. These he exhibited at the U. S. Mint and elsewhere; hoping to induce the Government to adopt the alloy for coinage. His hope was not realized, and the piece, represented by Fig. 33, remains the only monument of his endeavor. It weighs 40 grains.

Fig. 33.

THE AMERICAN NICKEL WORKS.
Camden, N. J., Dec. 1, 1876.
Proprietor, JOSEPH WHARTON,
Post-Office Address: P. O. Box 2786, Philadelphia, U. S. A.

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